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Dated 30 SEP 1996

Patents Form 1/77

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(see the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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1. Your reference — SP/N4407

2. Patent application number *(The Patent Office will fill this part)* — 9603332.9 — 14 FEB 1996

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

THOMSON CONSUMER ELECTRONICS INC.
600 North Sherman Drive
Indianapolis, Indiana 46206
United States of America

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — Delaware, U.S.A. 4140026001 AJS

4. Title of the invention

INTERFACE FOR DIGITAL RECORDER AND DISPLAY

5. Name of your agent *(if you have one)* — Williams, Powell & Associates

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

34 Tavistock Street
London
WC2E 7PB

Patents ADP number *(if you know it)* — 5830310001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority appliation number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earleir UK application, give the number and the filing date of the earlier application.

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(answer 'Yes if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Yes

Patents Form 1/77

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Continuation sheets of this form	
Description	8
Claim(*s*)	-
Abstract	-
Drawing(*s*)	1

10. If you are filing one of the following, state how many against each item.

Priority documents	-
translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination and search *(Patents Form 9/77)*	-
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	

11. I/we quest the grant of a patent on the basis of this application.

Signature

Date 14/02/96

12. Name and daytime telephone number of person to contact in the United Kingdom — Mr S. Frazier 0171 836 3336

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Notes

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INTERFACE FOR DIGITAL RECORDER AND DISPLAY

This invention relates to the field of digital video recording and in particular to coupling between various equipment components.

BACKGROUND OF THE INVENTION

A digital video signal may be processed to form a bit stream having a reduced bit rate. Such processing for bit rate reduction may be implemented according to an MPEG compression method, and may be formatted, for example, with an MPEG compatible structure, such as that employed in a digital satellite system signal or a proposed Grand Alliance or GA signal.

A specification of the GA signal is included in a draft specification document titled Grand Alliance HDTV System Specification, published in the 1994 Proceeding of the 48th Annual Broadcast Engineering Conference Proceedings, March 20 - 24 1994. Both the digital satellite system signal and the GA signal employ MPEG compatible coding methods which utilize an intra-coded frames, termed I frames, a forward predicted frames, termed P frames and bidirectionally predicted frames, termed B frames.

A consumer video recorder may be adapted to provide recording capabilities for both analog signals and digitally encoded signals having, for example, an MPEG like bit stream with, for example, the GA signal having a bit rate of approximately 20 M. bits per second. The adapted consumer video recorder may be considered as two electronic systems within one box, sharing a recording mechanism, servo and control systems. A conventional analog recording method is employed where an analog luminance signal component frequency modulates an RF carrier and an analog chrominance signal component amplitude modulates a second RF carrier. When reproduced, the two modulated signals are demodulated, combined and coupled out for video display.

During both record and replay operating modes, the video recorder may indicate, by the use of on screen display messages, operational status, warning conditions, tape duration, record time etc. These on screen display messages or OSDs are added to the analog video output signal which may be displayed to provide the user with recorder status information.

Digital recording may be achieved by using the consumer video recorder as a digital bit stream recorder / reproducer. The MPEG like bit stream may be formatted for bit stream recording by the addition of error detection and correction data words. The bit stream with error correction may be formatted into recording data blocks or sync blocks containing a predetermined number of bytes which may be accommodated in each recorded track. The sync block signal may be modulated to render the signal more suitable for digital recording, for example, to remove any DC component, or provide spectral shaping of the recorded signal, such modulation may be produced by "code book" type encoding. In a playback mode the recording processes are effectively reversed, for example, the "code book" encoding is decoded, errors are detected and corrected and the sync block formatting is removed restoring the bit stream to the original MPEG like format.

The consumer digital recorder provides a delay means which enables later viewing of digitally recorded video signals. The recorder may be considered to repackage the MPEG like bit stream without changes or additions. Thus MPEG decoding and encoding is not required within the recorder and little additional cost is added to the recorder. However, recorder status and warning displays, which in the analog machine are added to the analog output signal may be absent when operating in the digital mode. Hence, recorder status may only be ascertained by observation of the recorder control panel.

System interconnection and control between a digital signal source, recorder and monitor display may be simplified by the use of a bi-directional data bus. However, any interconnection additional to that of an analog system may present the user with incomprehensible installation complexity and confusion. A simple interconnection method is required which may provide coupling between a digital signal source and display regardless of a recorder's operational status. The simple interconnection method must facilitate both analog and digital recorder operation by utilizing the same interconnection system. In addition, recorder status and warning messages are required for user display during both analog and digital recorder operating modes.

BRIEF DESCRIPTION OF THE DRAWING

FIGURES 1A and 1B are exemplary block diagrams including various inventive embodiments.

DETAILED DESCRIPTION

A simplified consumer digital video receiver, recorder and display system is illustrated in the exemplary block diagram of FIGURE 1A. The system illustrated employs a digital video signal source, for example an integrated receiver decoder or IRD 100, an audio video display device 300 and a digital video cassette recorder 200, for example employing a D-VHS format. In the illustrated system, a digital video representative signal is modulated on an RF carrier and is received by an antenna 50. Antenna 50 is coupled to an integrated receiver decoder IRD 100. However, a modulated carrier may be delivered to receiver 100 by a cable distribution system (not shown). The integrated receiver decoder 100 is tuned to the RF carrier frequency and demodulates therefrom an MPEG like transport data stream modulation.

The transport data stream may be decoded to reproduce analog video and audio signals for immediate monitoring by audio video display 300. The analog audio and video signals are represented by signals 101 and 104, which are coupled between IRD 100 and display 300. Cost considerations dictate that the digital recording and replay capability of recorder 200 does not include MPEG encoding and decoding. Hence digital recorder 200 functions as a bit stream recorder / player, providing only time shifting or program delay capability. The lack of MPEG processing and the degree of complexity required to facilitate non-standard speed replay, renders the recorder incapable of reproducing image data in SHUTTLE, SLOW MOTION or TRICK-PLAY modes. Since no MPEG processing occurs in the recorder, a demodulated bit stream input is coupled from IRD 100 for recording, and a reproduced bit stream is coupled to IRD 100 for MPEG decoding, and audio / video generation. In addition, since bit stream processing is not provided in the recorder, status messages in the form of on screen display messages or OSDs cannot be combined or added to the bit stream. Thus the operational status of the recorder is not readily available to the user.

In addition, since recorder image data is only available in RECORD, PLAY and STOP modes, the user may be uncertain as to the responsiveness of the recorder following control commands. For example, transitioning from PLAY to REWIND may result in the replay image switching for example, to the input bit stream, a condition known as E to E, or for example, the replay image may disappear and be replaced by frozen frame derived by the IRD, or the moving image may be substituted by a colored field. The user may not be readily associated these visual display effects as indicia of recorder mode responsiveness.

The system illustrated in FIGURE 1A, shows an inventive interconnection arrangement where a transport bit stream is coupled from receiver IRD 100 to recorder 200 via a bi-directional data bus 112. The transport bit stream is coupled to the data bus via an interface port 110 and is received at recorder 200 by means of interface port 210. The interface ports are controlled via a CE control data stream which is carried on a separate bus included with data bus 112. Control signals may be derived from user input by activation of control switches, variously located, or by user generated IR remote control commands. For example, a user may chose to monitor a digital audio video signal received by dish antenna 50. The receiver may be selected by touch or via a remote control, for example IR. Receiver selection may result in automatic monitoring display selection, i.e. the display automatically is switched to monitor the receiver audio video output. The user may select a digital RECORD mode which outputs the MPEG like data stream from IRD 100 on bus 112 and initiates recording. Similarly selection of a digital PLAY mode results in a replayed data stream being coupled to bus 112 for decoding by IRD 100.

The MPEG like bit stream coupled to recorder 200 is processed for recording by block D. REC. 210. Block D. REC. 210 buffers the data stream to establish a nominally constant data rate. The buffered data stream is read from the buffer to form record format sync blocks which may be encoded with error detection / correction data words. The sync block formatted data stream may be modulated for recording as described, and coupled from recording block D. REC. 210 via a selector switch A4. Selector switches A4 and

A5 are controlled responsive to the D-VCR operating mode selected. For example, in FIGURE 1A switches A4 and A5 are depicted for digital recording and reproduction, with switch contacts DR, digital record and DP digital playback coupling data streams to and from rotating head assembly 250. For analog operation, switches A4 and A5 assume the alternate position as indicated by AR, analog record and AP analog playback. The sync block formatted data stream from D. REC. 210 is coupled to rotating head assembly 250 for recording on a magnetic tape.

The recorded sync block formatted data stream is replayed from the magnetic tape by heads positioned on assembly 250. The recovered signal is demodulated by digital replay block D. Rep. 220, to remove any recording channel modulation. The replay signal is then subject to error detection and correction by means of the data words inserted prior to recording. Following error correction, the sync block formatting is removed and the bit stream restored to an MPEG like format. The MPEG like stream is coupled from block D. Rep. 220 to interface port 210 which, in response to recorder operation in a PLAY mode couples the bit stream to the bi-directional data bus 112 for decoding by IRD 100.

Integrated receiver decoder 100 decodes the MPEG like bit stream and generates both video and audio output signals. For example, FIGURE 1A illustrates video and audio output signals 101 and 102 and an S-Video signal 104. However, these digitally recorded video signal components are without recorder status display information in the form of an on screen display.

Integrated receiver decoder IRD 100 has status display capability in the form of on screen display messages. Advantageously recorder 200 status messages may be coupled via data bus 112 to IRD 100 to utilize the receiver on screen display capability. The status messages may be coupled as message data, as look up table address to access stored messages within IRD 100 or as video signals. However, modification may be required to access and output recorder status, together with additional control and message generation within receiver 100.

Recorder 200 is illustrated with an on screen display generator 270, coupled to a control system CTRL 205. In response to

signals from control system 205, on screen display generator 270 generates appropriate status or warning messages. These messages are coupled for insertion or inclusion with an analog video signal in adder block 275. Analog video signals are coupled to the on screen display adder 275 from a video selector block SEL. 280. Selector 280 is controlled by control system 205 and provides selection capability between various analog signal sources. For example, switch A1 provides analog input signal selection between a tuner derived signal, a baseband analog signal input and an IRD A/V output signal 102. The output from switch A1 is coupled for analog recording by block A. REC.

Switch A3 of selector SEL 280 advantageously provides selection of signal coupling to on screen display adder 275. Switch A3, of FIGURE 1A is shown inventively coupling IRD A/V output signal 102 for recorder message insertion by adder 275. Thus a digitally derived replay signal 102 may have recorder status information added in the form of an on screen display. During analog operation switch A3 couples the analog replay signal for OSD insertion. In summary, during analog operation OSD messages are added to the analog replay video signal. When digital operation is selected, OSD messages may be advantageously added to the analog video signal decoded from the recorded bit stream by IRD 100. Thus the user may be appraised of the recorder operational status by viewing analog signal 103 on display 300.

Switch A2 of selector SEL 280 advantageously provides a bypass connection to allow IRD A/V output signal 102 to be coupled to monitor display 300, thus allowing direct viewing of the receiver's decoded output. The bypass path may be automatically selected when the recorder is OFF or in a STAND BY mode, or when viewing a decoded non-recorded bit stream. To permit viewing of decoded non-recorded signals during analog recording, the bypass switch may be manually activated. The advantageous bypass connection obviates unnecessary analog recorder signal processing and potential degradation of IRD A/V output signal 102. In addition the advantageous bypass function provided by switch A2 allows receiver IRD 100 to be connected to monitor display 300 without regard to the operational status of recorder 200.

The status or warning messages produced by OSD generator 270 are generated with specific horizontal and vertical synchronizing timing such as produce a predetermined display position on screen. However, when operating in the digital recording mode, messages may be generated with different horizontal and vertical synchronizing timing to compensate for IRD processing delay in order to achieve the specific on screen position. However IRD decoding and processing delay may include multiple frames, amounting to about 0.5 second. This multiple frame delay may be compensated by adjustment of OSD generation timing in order that the user may not perceive a time difference between the visual result of the control command and the appearance of the corresponding OSD presentation.

FIGURE 1A illustrates a monitor display 300 having three analog signal inputs; audio video signals 101 and 103, and an audio and component video signal 103, for example, S-video or Y, Pr, Pb luminance and coloring components. In addition, display 300 may receive audio and video signals via radio frequency signals, depicted as RF IN. A signal selector 310, couples as is known, to video and synchronizing processing circuitry, not shown, which in combination generate an image display. Signal selector 310, may be controlled by user activated switches located on display 300, or by user initiated remote control commands transmitted via a modulated IR control stream. The three baseband input signal illustrated may be selected by automated control of selector switch 310. For example, selection of digital recording or replay modes may automatically select an input signal containing recorder OSD status display information. The recorder status OSD may be generated and originate as previously described. In addition, the provision of multiple baseband signal inputs may allow function specific device interconnection. For example, the direct viewing of a decoded, non-recorded, signal from IRD 100 may be facilitated by use of, for example, output signal 101, or component video signal 103, with IRD output signal 102 routed for OSD insertion to form A/V signal 103.

In a reduced cost display, for example, as illustrated in FIGURE 1B, the number of signal inputs may be limited to, for example, RF, S-video and one audio video signal input. The

advantageous selection and bypass capability of selector 280, permits display 301 to monitor both recorded, and non-recorded material via the single A/V input. However, the display may utilize the S-Video connection to determine display input selection in addition to signal coupling. For example, the S-VIDEO signal or component signals may be assumed to provide superior display image quality, and hence may automatically cause selection of an S-VIDEO signal source. Thus this S-VIDEO input selection may inhibit monitoring of signals containing OSD information coupled from recorder 200. However, this automatic S-VIDEO input selection may be advantageously utilized to permit selection of the second baseband input. Signals containing OSD information may be viewed by controlling, in IRD 100, the presence or absence of S-VIDEO signal 104. For example, display selection of a non-recorded bit stream will result in the generation and output of S-VIDEO signal 104. The display selection of a recorded image signal will terminate generation or outputting of S-VIDEO signal 104, thus causing the display to switch from the S-VIDEO input and select A/V signal 103, coupled from selector 280.

FIG. 1A

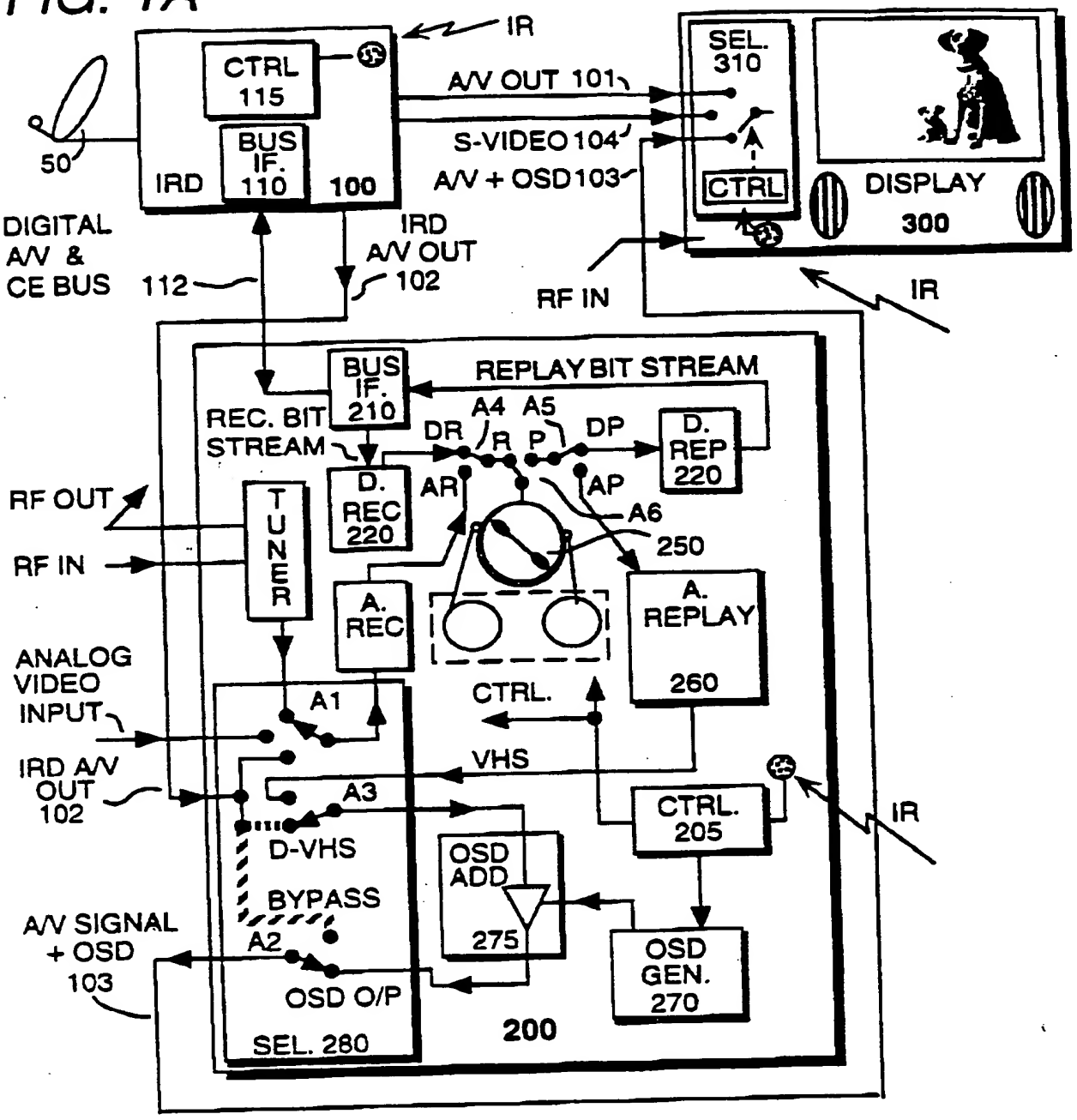
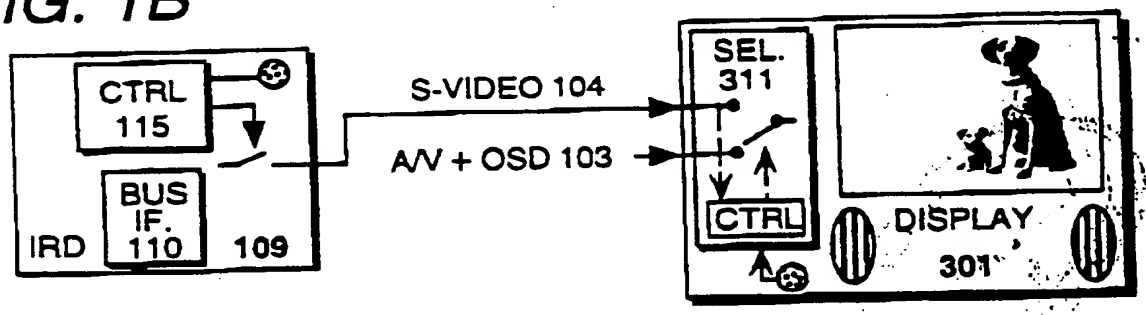

IR
CTRL 115
BUS IF. 110
IRD
100
50
A/V OUT 101
S-VIDEO 104
A/V + OSD 103
SEL. 310
CTRL
DISPLAY 300
DIGITAL A/V & CE BUS
112
IRD A/V OUT 102
RF IN
IR
BUS IF. 210
REPLAY BIT STREAM
REC. BIT STREAM
A4 A5
DR R P DP
D. REP 220
D. REC 220
AR
AP
A6
250
RF OUT
RF IN
TUNER
A. REC
A. REPLAY 260
ANALOG VIDEO INPUT
A1
CTRL.
IRD A/V OUT 102
VHS
A3
CTRL. 205
IR
D-VHS
OSD ADD 275
BYPASS
A/V SIGNAL + OSD 103
A2
OSD O/P
OSD GEN. 270
SEL. 280
200

FIG. 1B


CTRL 115
BUS IF. 110
IRD
109
S-VIDEO 104
A/V + OSD 103
SEL. 311
CTRL
DISPLAY 301